NO PRIOR DISCUSSION

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
4 October 2001 (04.10.2001)

PCT

(10) International Publication Number
WO 01/72601 A1

(51) International Patent Classification[7]: B65D 79/02, G01K 11/06

(21) International Application Number: PCT/SE01/00650

(22) International Filing Date: 26 March 2001 (26.03.2001)

(25) Filing Language: Swedish

(26) Publication Language: English

(30) Priority Data:
0001069-4 27 March 2000 (27.03.2000) SE

(71) Applicants and
(72) Inventors: **NORRBY, Henry** [SE/SE]; Öjevägen 69, S-820 40 Järvsö (SE). **NYGÅRDH, Mats** [SE/SE]; Myra 2289 A, S-820 40 Järvsö (SE).

(74) Agent: **JOHANSSON, Lars**; Lars Johansson Patentbyrå AB, Box 68, S-801 02 Gävle (SE).

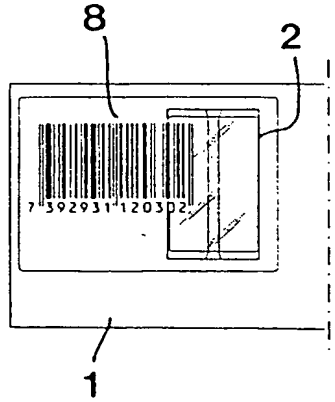
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
-- *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: PACKAGE FOR KEEPING GOODS IN A TEMPERATURE-DECREASED, PRESERVATIVE STATE AND A TEMPERATURE INDICATOR THEREFOR



(57) Abstract: In a first aspect, the invention relates to a package (1) for keeping goods in a temperature-decreased, preservative state, in which the temperature should have a certain desired value. According to the invention, the package is connected to a temperature indicator (2) comprising means, which preserves a certain property when the temperature of the goods is decreased towards and past a predetermined limit value, which is at least somewhat higher than said desired value, but which alters this property in an irreversible way if the temperature during the storage would rise to or above said limit value. Advantageously, the temperature indicator (2) may be transparent as long as the temperature is lower than said limit value, but become opaque when the limit value is exceeded, e.g. in order to make reading of a bar-code (8) impossible. In a second aspect, the invention also relates to the temperature indicator as such.

WO 01/72601 A1

PACKAGE FOR KEEPING GOODS IN A TEMPERATURE-DECREASED, PRESERVATIVE STATE AND A TEMPERATURE INDICATOR THEREFOR

Background of the invention

Deep-frozen foods are handled daily in large amounts in the food sector. During the whole period between production, when the goods are deep-frozen, and retail sale to the final consumer, it is of vital importance that the temperature of the package does not exceed a certain recommended desired value, which, for deep-frozen products, usually is -18 °C. If the article during a certain time unintentionally would obtain a higher temperature than the recommended desired value, the risk of deterioration of the quality of the article is run, and if the exposure to the higher temperature would become long, the article may become directly unhealthy by growth of bacteria and the like. In practice, the handling of the article from the producer to the consumer includes a plurality of different steps, such as storage (long term as well as short term storage), transhipments, transports as well as handling in the shop. There are, per se, rather strict rules and recommendations how the temperature of the goods should be supervised and documented during these different phases, but in practice said rules are difficult to completely observe. If the individual article at some point of time by misadventure, or in another way, would be exposed to a higher temperature than the recommended highest desired value, neither the consumer nor the other parties in the chain between producer and consumer can see this on the proper package. In this connection, it should be emphasized that there is not only a general consumer interest to know whether deep-frozen goods temporarily have been thawed, but also the actors who participate in the delivery chain up to the consumer have the same interest. In a shop, a freezer breakdown may for instance take place, which means that certain, but not all packages in the freezer or the individual freezing-compartment, are exposed to

increased temperatures. The shop manager will then have a marked economic interest to be able to ascertain exactly which packages, on one hand, have to be discarded and which packages, on the other hand, may be saved for sale.

What has mentioned said above concerning packages with deep-frozen goods is analogously valid also for cold goods, e.g. meat and the like. Here, however, the desired temperature is above 0 °C. For meat, for instance, the desired value is +6 °C. It should also be pointed out that the problem with unintentional temperature rises is not limited only to food-stuffs. Thus, also other goods, such as medicines, photographic film, and the like, may lose its quality in the same way.

Objects and features of the invention

The present invention aims at managing the above-mentioned problem. Therefore, in a first aspect, the invention aims at providing a package from which may be read whether the package temporarily has been exposed to an inappropriate temperature. In another aspect, the invention aims at providing a temperature indicator, which, for the same object, may be connected to packages, i.e. to indicate whether the package has been exposed to an inappropriate temperature.

According to the invention, at least the primary object of the package according to the invention is attained by the features defined in the characterizing clause of claim 1. Preferred embodiments of the package according to the invention are furthermore defined in the dependent claims 2-6.

The primary features of the temperature indicator according to the invention are evident from claim 7. Preferred embodiments of the temperature indicator according to the invention are furthermore defined in the dependent claims 8-10.

Brief description of the appended drawings

In the drawings:

Figs 1-3 are schematic perspective views showing three packages with different temperature indicators according to the invention,

Figs 4 and 5 are partial side views of a package, one and the same temperature indicator being shown in two different functional states,

Fig 6 is a very enlarged front view showing the temperature indicator in the state according to fig 4,

Fig 7 is an analogous front view showing the indicator in the state according to fig 5, and

Fig 8 is a cross-section through the temperature indicator according to figs 6 and 7.

Detailed description of preferred embodiments of the invention

Figs 1-3 schematically illustrate three packages 1 for storage of an article in a temperature-decreased, preservative state, in which the article should have a certain desired value, e.g. -18 °C, if the article is deep-frozen. Generally characterizing the invention is that a temperature indicator 2 is connected to the package, said indicator comprising means, which preserves a certain property when the temperature of the article is decreased towards and past a predetermined limit value which is at least somewhat higher than said desired value, but which alters this property in an irreversible way if the temperature during storage would rise to or above said limit value. As will be described below in connection with figs 6-8, said means may initially be transparent and arranged to retain the transparency thereof during temperature reduction past said limit value and said desired value, but be converted to an irreversibly opaque state if the temperature would rise above the limit value.

Reference is now made to figs 6-8, which illustrate a concrete example of a temperature indicator according to the

invention. In this indicator, two different casings are included, viz. an outer casing 3 and an inner casing 4, which has the purpose of separating a first liquid mixture 5 from a second liquid mixture 6. Thus, the inner casing 4 forms a partition wall between the two liquid masses 5 and 6. Generally, the two liquid mixtures are of different chemical compositions in order for the first liquid mixture to have a lower freezing point than the second one. In the concrete example, the liquid 5 in the outer casing 3 is assumed to consist of a mixture of spirit and water in such proportions that the freezing point of the liquid is at, e.g., -16 °C. In addition, the liquid contains an alkaline compound, such as bicarbonate, as well as a salt, e.g. phenolphthalein, which becomes coloured in an acid environment, but not in an alkaline one. Also the liquid 6 in the inner casing 4 may consist of a mixture of spirit and water, although in such proportions that the freezing point for this liquid is at least somewhat higher than the freezing point of the liquid 5. The freezing point of the liquid 6 may, for instance, be -12 °C. In the liquid 6, a suitable acidifying compound is also included, e.g. acetic acid. The outer casing 3 is made of a material, e.g. a thin and soft plastic film, which resists low temperatures without becoming brittle or otherwise degradable. Contrary to this, the material in the inner casing 4 should be of such a type that the material preserves a fundamental elasticity or softness at degrees above zero, but becomes brittle and degradable at a certain, lower temperature, e.g. -12 °C.

In practice, the shown colour indicator may be manufactured by filling the two liquid mixtures 5, 6 in long narrow, thin plastic film casings, which are cut off individually and sealed by means of butt welds 7. As seen in fig 8, the indicator has a flat basic shape, and may, on one of the two opposite major faces thereof, be provided with a layer (not shown) of glue or other adhesive for a permanent application of the indicator on a package.

In fig 1 is illustrated how a rectangularly shaped colour indicator 2 may be applied in a countersink in the surface of the package 1. In fig 2, a countersunk temperature indicator 2 is shown, having a round basic shape. In fig 3 is illustrated how the colour indicator 2 may be in the form of a label pasted on the outside of the package.

After the temperature indicator has been applied to or integrated into the package and the article in question has been packed in the package, refrigeration of the package and its content starts. Conventionally, refrigeration is carried out at very low temperatures in order to hasten the freezing process. Inside the temperature indicator, the following then takes place: As the temperature falls from the room temperature, heat is transported from the liquids 6, 5 via the casings to the cold surrounding. When the temperature in the liquid 6 falls, the volume of the liquid decreases at the same time as the volume of the inner casing 4 decreases, the material in this casing becoming more brittle. When the temperature has fallen to -12 °C, the liquid 6 freezes to ice and begins to expand. Somewhat later also the liquid 5 begins to freeze to ice and to expand. When the ice 6 expands the inner casing 4 cracks, whereby an irreversible communication path to the ice 5 arises. The expansion of the ice 5 can take place without the casing 3 being damaged or effected, since the material in said casing preserves its softness and tightness at a considerably lower temperature than the inner casing. On this occasion, i.e. as long as the temperature is below -12 °C, no reaction takes place between the liquids 5, 6 because the same are in the state of ice. The temperature indicator according to the invention is now adapted.

If the package 1 and the temperature indicator 2 thereof on some occasion during the handling from the producer to the consumer unintentionally would come to thaw by being exposed, during a marked time, to temperatures above -12 °C, first the ice mass 5 and then the ice mass 6 will melt and

return to the liquid state. By the fact that the inner casing 4 has cracked at the refrigeration occasion (illustrated by the rupture in fig 7), the acid liquid 6 may ooze out into the liquid mass 5 and acidify the same, a chemical reaction takes place, during which the salt (e.g. phenolphthalein) in the liquid 5 becomes coloured. In other words, in this way the initially transparent state of the liquid is altered to an opaque, coloured state. This change of state is not reversible and will subsist also if the package and the content thereof are frozen down again.

In practice, the temperature indicator should have a certain delay in the function thereof by requiring a certain quantity of thermal energy in order to melt the ice masses 5, 6 before the reaction takes place. This means that the indicator does not react immediately at a temperature rise. By the fact that the reaction is delayed, it is guaranteed that an indication of an exceeding of the limit temperature does not arise by virtue of a momentary supply of heat, e.g. by hand contact during manual handling in a shop or the like.

In figs 4 and 5, a particularly preferred embodiment of the invention is illustrated, applied to such packages that in a conventional way include a bar-code 8. In this case, a temperature indicator 2 is applied in such a way that the same at least partly covers the bar-code. In the transparent state according to fig 4, the temperature indicator constitutes no obstacle for reading the bar-code by means of a conventional, stationary or mobile code reader, e.g. at a shop's cash-point. Therefore, if the temperature indicator 2 assumes the transparent state thereof on the occasion of sale to the final consumer, the consumer as well as the shop manager can with certainty observe that the article has not been submitted to refreezing because the bar-code can be read. However, if the article for one reason or another would have been thawed and again refrigerated, the transparent state of the temperature indicator is converted to the opaque state, which is shown in

fig 5. In this state, a reading of the bar-code in its entirety is made impossible, whereby the attention of the consumer, as well as the shop manager, at the latest in connection with the sales occasion, is drawn to the fact that the article has been thawed and re-frozen.

Feasible modifications of the invention

The invention is not solely restricted to the embodiments described above and shown in the drawings. Thus, it is feasible, within the scope of the invention, to resort to other means than liquid mixtures in order to execute the desired change of state or property of the temperature indicator. For instance, it is possible to attain an analogous function by means of temperature sensitive crystals in a solid, gel-like or liquid state in suitable combinations. A crystal mass made in a suitable way may then be applied to a thin carrier, e.g. tape, having a suitable shape, and then the carrier is applied to the outside of the package, e.g. by being pasted thereon. A temperature indicator made in this way by means of temperature sensitive crystals may in practice be used not only for frozen goods but also for cold goods, the desired temperature of which being above 0 °C but considerably below room temperature. The crystal mass may also be applied directly to the package by printing or painting. It should also be pointed out that other changes of conditions than between transparency and opacity are feasible, e.g. simple colour changes, volume changes, location changes or combinations thereof.

Claims

1. Package for keeping goods in a temperature-decreased, preservative state in which the temperature should have a certain highest desired value, c h a r a c t e r i z e d in that a temperature indicator (2) is connected to the same (1), which indicator comprises means (5, 6), which has a certain property when the temperature of the article is decreased towards and past a predetermined limit value which is at least somewhat higher than said desired value, but which alters said property in an irreversible way if the temperature during the storage would rise to or above said desired value.

2. Package according to claim 1, c h a r a c t e r i z e d in that said means (5, 6) is initially transparent and preserves the transparency thereof during temperature reduction past said limit value and said desired value, but is converted to an irreversible opaque state if the temperature would rise above the limit value.

3. Package according to claim 1 or 2, c h a r a c t e r i z e d in that the temperature indicator (2) is integrated with the package (1) by being included in an external surface thereof.

4. Package according to any one of the preceding claims, c h a r a c t e r i z e d in that the temperature indicator is in the form of a thin label.

5. Package according to claim 2 and 4, c h a r a c t e r i z e d in that the temperature indicator (2) is applied to the outside of a bar-code (8) exposed on an external surface of the package (1) in order to at least partly cover the same and, on one hand, in the transparent state thereof permit reading of the code, but on the other hand in a possibly

occurred, opaque state make conventional reading of the code impossible.

6. Package according to any one of the preceding claims, c h a r a c t e r i z e d in that said means in the temperature indicator consists of two liquid mixtures (5, 6) having different chemical compositions, a first one (5) of which having a lower freezing point than the second one (6) and being spaced-apart from this via a partition wall (4) initially being liquid-tight, but which, upon refrigeration to a certain limit temperature above said desired temperature, looses the liquid tightness thereof, the two liquid mixtures (5, 6) preserving their properties in a frozen state, but being altered irreversibly if heating would take place to or above said limit temperature, more precisely by the fact that the second liquid mixture penetrates out into the first one and is mixed therewith while causing a chemical reaction with the ensuing change of state.

7. Temperature indicator for packages intended for keeping goods in a temperature-decreased, preservative state in which the temperature should have a certain highest desired value, c h a r a c t e r i z e d in that the same comprises a means (5, 6), which has a certain property when the ambient temperature is decreased towards and past a predetermined limit value which is at least somewhat higher than said desired value, but which alters this property in an irreversible way if the temperature would rise to or above said limit value.

8. Temperature indicator according to claim 7, c h a r a c t e r i z e d in that said means (5, 6) is initially transparent and preserves the transparency thereof during temperature reduction past said limit value and said desired value, but is converted to an irreversibly opaque state if the temperature would rise above said limit value.

9. Temperature indicator according to claim 7 or 8, c h a r a c t e r i z e d in that the same is in the form of a thin label (2).

10. Temperature indicator according to any one of claims 7-9, c h a r a c t e r i z e d in that said means in the temperature indicator consists of two liquid mixtures (5, 6) having different chemical compositions, a first one (5) of which having a lower freezing point than the second one (6) and being spaced-apart therefrom via a partition wall (4) initially being liquid-tight, but which, upon refrigeration to a certain limit temperature above said desired temperature looses the liquid tightness thereof, the two liquid mixtures (5, 6) preserving their properties in a frozen state, but being altered irreversibly if heating would take place to or above said limit temperature, more precisely by the fact that the second liquid mixture penetrates out into the first one and is mixed therewith while causing a chemical reaction with the ensuing change of state.

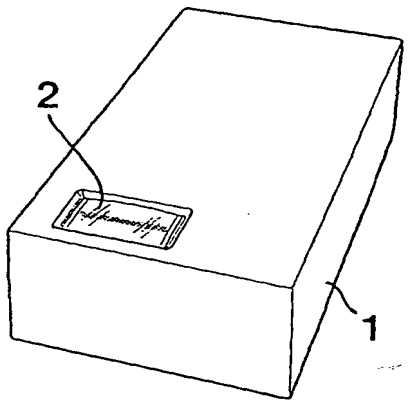


Fig 1

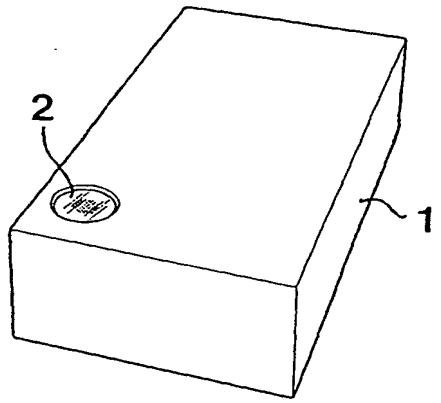


Fig 2

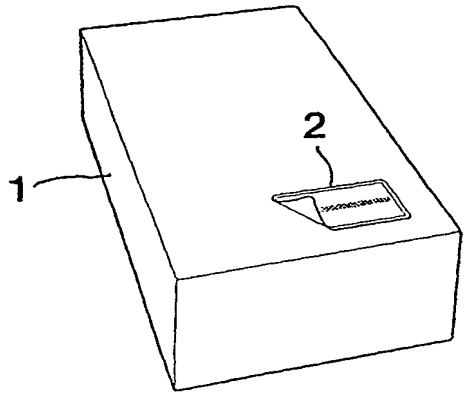


Fig 3

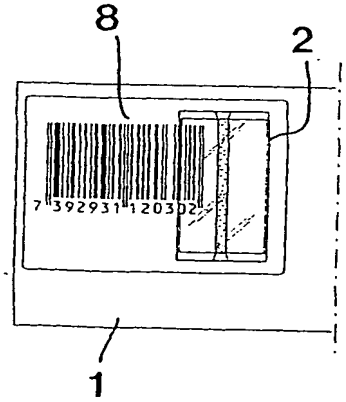


Fig 4

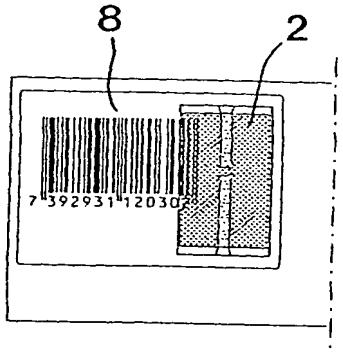


Fig 5

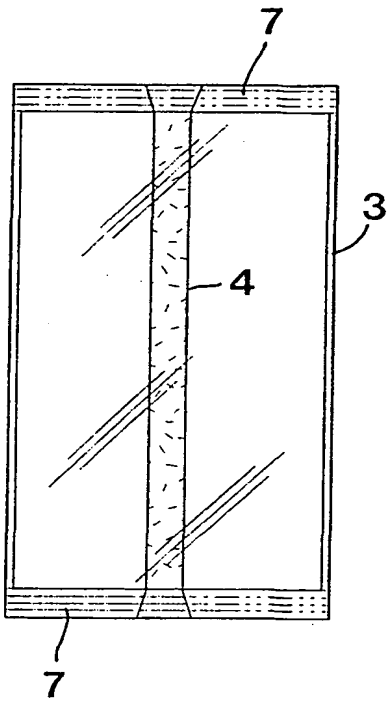


Fig 6

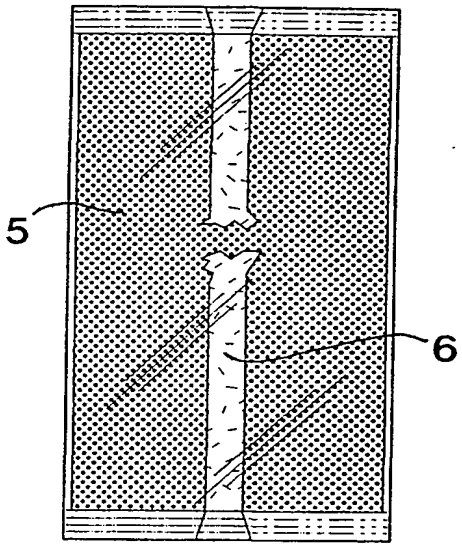


Fig 7

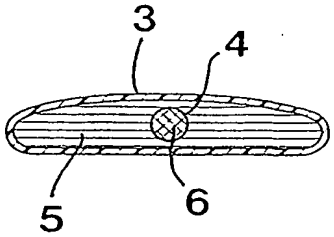


Fig 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 01/00650

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B65D 79/02, G01K 11/06
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B65D, G01K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4457252 A (MANSKE), 3 July 1984 (03.07.84), column 1, line 65 - column 2, line 26, figures 1-3	1-10
A	DE 2617046 A1 (HILL, ROBERT, DR), 20 January 1977 (20.01.77), figures 1-2, claim 1	1-10
A,P	DE 19912529 A1 (WAGNER, M, DIPL.ING, PAT ANW,), 28 Sept 2000 (28.09.00), figures 1-4, abstract	1-10
A,P	DE 20011465 U1 (MüLLER, FLORIAN), 30 November 2000 (30.11.00), figures 1-2, abstract	1-10

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 April 2001	25 -04- 2001
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Beata Slusarczyk/EK Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

25/02/01

International application No.
PCT/SE 01/00650

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4457252 A	03/07/84	CA 1204028 A	06/05/86
		DE 3377810 D	00/00/00
		EP 0112023 A,B	27/06/84
		SE 0112023 T3	
		JP 1692076 C	27/08/92
		JP 3060051 B	12/09/91
		JP 59104537 A	16/06/84
DE 2617046 A1	20/01/77	JP 52003479 A	11/01/77
		US 3958528 A	25/05/76
DE 19912529 A1	28/09/00	NONE	
DE 20011465 U1	30/11/00	NONE	